embodiments of the DPs **20**A, **21**A, **22**A, and **24**A include but are not limited to general purpose computers, special purpose computers, microprocessors, digital signal processors (DSPs) and multi-core processors.

[0041] While various example embodiments have been described above it should be appreciated that the practice of the invention is not limited to the example embodiments shown and discussed here. Various modifications and adaptations to the foregoing example embodiments of this invention may become apparent to those skilled in the relevant arts in view of the foregoing description.

[0042] Further, some of the various features of the above non-limiting embodiments may be used to advantage without the corresponding use of other described features.

[0043] Initially we will discuss the functions that are required to enable UL-CoMP and their functionalities. In distributed UL CoMP, the CoMP functionality is distributed between all participating cells. The request/response, master/slave interaction between a serving cell and its neighboring helper cells perform request/response, master/slave interactions, with the intelligence concentrated in the serving cell function. All participating cells perform both serving cell and helper cell functions. Some embodiment of the invention disclose a method whereby a scheduling interval (e.g. TTI), the serving cells determine, per scheduled UE, a set of helper cells to instruct to send symbols from the UEs RB allocation (antenna data) as received by the helpers, and/or pilot symbols from the UEs RB allocation, and in addition, a method to manage the case where a helper cell is oversubscribed with regards to an available front-haul bandwidth. For example, in a TTI:

   [0044] the serving cell determines, for a scheduled UE that can benefit from UL CoMP, a set of helpers to request antenna data from (e.g. the UEs allocated UL RBs received at the helper, including pilot symbols).

   [0045] the serving cell determines, for the scheduled UE that can benefit from UL CoMP, a set of helpers to request only pilots from (e.g. pilot symbols in the UEs RB allocation received by the helper).

[0046] In some embodiment of the invention, the helper cells, upon request from a serving cell, send the requested pre/post combined antenna data and/or pilot symbols. It is noted that the data may include a combination of pre/post antenna data. The antenna data is then used by the serving cells UL CoMP receiver to decode the UEs UL transmission. In some embodiment of the invention, the serving cell uses the pilot symbols received from the helpers to maintain IIR filtered SINR metrics of potential helpers for active UE(s) that can benefit from UL CoMP.

[0047] FIG. **3** illustrates an example of a neighbor set of carriers for spatial diversity of a transmission. As shown in FIG. **3** there is a neighbor set defined per cell, a Candidate Set 02 per user equipment (e.g., UE **22**), and a Reception Set 01 per UE per TTI. The Neighbor Set 03 is defined per cell and includes cells with an RF topological relationship to the serving cell, such that they can potentially be helpers to some UE in the serving cell. The Candidate Set is per UE and includes neighbor cells that are requested to provide reference signals (e.g. DMRS) sent from UE in the serving cell. The Reception Set is per UE per TTI and includes neighbor cells that are requested to provide UL data and pilot symbols sent from UE in the serving cell. The neighbor cell moves into UE's candidate set based on for example UE Measurement Reports. The candidate cell moves into UE's

reception set based on an SINR estimate from candidate cell antenna data (e.g. pilot symbols). It is noted that SINR estimates for the candidate and reception set cells can be computed in serving cell.

[0048] Enabling uplink joint reception CoMP may require co-operation among the cells in exchanging pre/post-processed antenna data signals, such as pre/post antenna data signals. Cells exchange pre/post combined antenna data, such as combined pre/post antenna data, (hence distributed UL CoMP) over communications links to create more diversity and interference rejection capability in LTE reception. Demodulation and decoding of all antenna data is accomplished at the serving cell. In distributed UL-CoMP, the CoMP functionality is split between all participating cells. UL-CoMP with distributed architecture has attracted more attention over centralized architecture due to its scalability and signaling latency. The distributed UL-CoMP solution has the following key components.

[0049] For distributed UL-CoMP functionalities, the serving (or primary) cell is the one in which the core network has attached a UE for wireless communication, backhaul is a name for a communication link to neighboring cells, and Core-Backhaul is a name for a communication link to the core LTE network.

[0050] Scan receiver measures potential helpers from neighbors using pilots symbols from requested over the backhaul;

[0051] Helper selection uses scan receiver output and long term metrics to select helper cells for UE reception (per TTI). This may be done to improve diversity performance and reduces "backhaul" bandwidth utilization;

[0052] Help Request is signaling to neighbor cells for scheduled receptions to forward pre/post combined antenna data in form of resource blocks for demodulation of data or pilot symbols for scanning;

[0053] Egress Control manages backhaul (and if same, core-backhaul) so it may not overflow with sum of help requests and help targeted for neighbor cells; and

[0054] Compression may optionally be used to further reduce backhaul.

[0055] Algorithms for two key-functionalities include Helper cell management and Egress bandwidth control.

[0056] Helper Cell Management:

[0057] The following are some examples of the functionalities of helper cell management:

[0058] SINR estimation at the serving cell,

[0059] IIR filtered SINR estimate at the serving cell for serving cell UEs at—their helper cells,

[0060] Per TTI selection of helper cells per UE,

[0061] A signaling request from the serving cell to UE selected helper cells, requesting transmission of the post FFT UE RB allocation (pre/post antenna combined)

[0062] A method for per UE candidate helper cell determination, and per UE reception set cell determination,

[0063] A signaling request from the serving cell to UE selected candidate cell not requested for helper RBs, requesting transmission of the DMRS pilot(s) associated with the UEs RB allocation,

[0064] A method to determine, per UE, a candidate set of helpers that may potentially provide help, and a per TTI determination of a Reception Set that will provide help, which is a subset of the candidate set, and/or